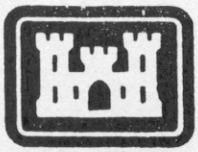

US Army Corps
of Engineers
Omaha District

Lake Francis Case Aggradation Study (Including White River) 1953 - 1986

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SECTION I - INTRODUCTION

1. Purpose

1.1. The objective of this study is to document an overview of the geomorphic conditions and trends for Lake Francis Case. Of specific interest to this study is the nature, extent and quantification of sediment aggradation within the reservoir. The study presents project statistical data, profiles of the aggradation ranges, bed and suspended sediment data, density of sediment deposits data, pool elevation records, capacity and sediment depletion data, and shoreline erosion information.

1.2. The study area includes the 108-mile reach of the Missouri River upstream from Fort Randall Dam and the 20-mile reach of the White River immediately upstream from its confluence with the Missouri River. The water body bounded by these limits is known as Lake Francis Case. The entire study area is located in South Dakota. The study area location is shown on Plate I.1[1].

1.3. The purpose of the study is to provide a record of basic observations and tabulations of field data on Lake Francis Case Reservoir and to document pertinent geomorphic data and trends. The study utilizes existing data and background information resources that have been previously developed. No additional surveys or data development were undertaken for this study. The report presents data and trends in a format which may be used in following studies to predict future conditions in Lake Francis Case. However, forecasting based on the existing data is beyond the scope of this present investigation.

2. Scope of Work

2.1. The scope of work for the study was to provide a report which compiled, in a single document, all the pertinent data and

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[1] All plates, exhibits, and tables are presented in appendices that follow the text of this report. Appendix numbers match the corresponding section number of the report.

information relative to aggradation in Lake Francis Case and to analyze this data to determine trends in geomorphic changes over the historical record. The report is to be used as a reference document. Specific work elements included in the scope are:

- Provide project statistical data which will include information on Fort Randall Dam and Lake Francis Case.
- Develop plots for range cross sections incorporating up to eight surveys for the historical record on each range plot.
- Evaluate the hydraulic elements database for the survey ranges to develop profiles for the average bed elevation and thalweg elevation along the study reaches of the Missouri and White Rivers; and prepare plots of the hydraulic parameters versus stage at the survey ranges.
- Use reservoir volume by segment data to compile and tabulate reservoir capacity and sediment depletion over the period of record.
- Review bed material analysis data over the period of record.
- Evaluate suspended sediment records for the White River at Oacoma, SD.
- Evaluate density of sediment deposits data.
- Present shoreline erosion data.
- Prepare Engineering Form 1787.

3. Data Resources and Prior Investigations

3.1. The principal data source for materials used in this study are the files, records and database system of the Omaha District, Corps of Engineers, Omaha, Nebraska. This includes data materials collected by the Corps as well as those compiled by other agencies, which include primarily the U.S. Department of Interior, United States Geological Survey (USGS). The primary disposition of the data materials in the Omaha District is either microfilm files, hard copy of records, or the WASTORE database system. The data materials used for this study were supplied in the form of either

photocopies of microfilm records or other documents, or by data provided in ASCII format 5 1/4-inch floppy discs for use on microcomputers. A log of the data elements used in this study is given in Tables I.1 through I.6.

3.2. The data used in the analyses and presentation of this report consist entirely of available data resources. The acquisition of new data was beyond the scope of this work.

3.3. Several prior investigations have been completed which are pertinent to this study. The most comprehensive report to address the magnitude and problems related to aggradation in Lake Francis Case was the "Missouri River, Main Stem Lakes, Sediment Investigations Report"[1]. This report provides an overview of the Fort Randall Dam - Lake Francis Case project and its operation and quantifies sediment inflow and reservoir capacity depletion data as available up to the 1973 survey. Results from the Main Stem Lakes Study have been incorporated into this current study. Other prior investigations include the preparation of area-capacity tables in 1954 (1946-1947 survey), 1955 (original condition including storage above Big Bend Dam), 1961 (original condition with Big Bend Dam storage removed), 1966 (1962 survey), 1968 (1967 survey), 1978 (1977 survey) and 1983 (1981 survey). Engineering Form 1787 was prepared in 1957. This Form 1787 submittal covered the approximately 4-year period following closure of Fort Randall Dam.

3.4. Much of the data presentation, analysis and interpretation of results provided in this report is based on a series of eight comprehensive hydrographic surveys taken throughout Lake Francis Case. The nominal dates for these surveys are:

Survey	Nominal Date	Time Increment (Years)
1	June 1, 1953	--
2	August 1, 1957	4.17
3	August 1, 1962	5.00
4	June 1, 1967	4.88
5	July 15, 1973	6.08
6	June 1, 1977	3.96
7	July 15, 1981	4.04
8	August 15, 1986	5.08

The date for any specific range survey for a particular year may vary as has been shown in Table I.1. Analysis results such as area capacity tables, have been located for the 1957 survey. However, the actual range survey and hydraulic elements data for 1957 were not found during the course of this study. Further, it should be noted that the 1981 survey was only taken on the White River Arm of Lake Francis Case.

4. Sediment Related Problems

4.1. The "Mainstem Lakes, Sediment Investigations Report" of September 1975, identified three major sedimentation problems at the Fort Randall Project. These are: (1) a lack of channel degradation below the powerhouse tailwater channel, prohibiting maximum power production; (2) the White River delta encroachment, causing sediment deposition to fill tributary arms and limit access through the lake at low pool stages; and (3) shoreline erosion and sediment deposition at public use recreation areas. The public use areas affected the worst were the Elm Creek and Waterhole Creek areas (1960 River Miles 939 and 952 respectively). Each suffers because of tributary sediment inflow and delta encroachment. At present the deltas are being formed in the arms by tributary inflow, but eventually the recreational use areas will take on the added and more serious influence of the main stem delta.